



US007632320B2

(12) **United States Patent**  
**Tonkovich et al.**

(10) **Patent No.:** **US 7,632,320 B2**  
(45) **Date of Patent:** **\*Dec. 15, 2009**

(54) **CHEMICAL REACTOR FOR GAS PHASE  
REACTANT CATALYTIC STEAM  
REFORMING REACTIONS**

(58) **Field of Classification Search** ..... 422/190,  
422/191, 193, 195, 217, 218; 48/63, 127.7,  
48/76

See application file for complete search history.

(75) Inventors: **Anna Lee Y. Tonkovich**, Pasco, WA  
(US); **Yong Wang**, Richland, WA (US);  
**Sean P. Fitzgerald**, Richland, WA (US);  
**Jennifer L. Marco**, Pasco, WA (US);  
**Gary L. Roberts**, West Richland, WA  
(US); **David P. Vanderwiel**, Richland,  
WA (US); **Robert S. Wegeng**, Richland,  
WA (US)

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,795,618 A	1/1989	Laumen
4,801,620 A	1/1989	Fujitani et al.
5,075,277 A	12/1991	Saiai et al.
5,270,127 A	12/1993	Koga et al.
5,324,452 A	6/1994	Allam et al.
5,366,719 A	11/1994	van Wingerden et al.
5,417,938 A	5/1995	Shelden et al.
5,512,250 A	4/1996	Betta et al.
5,518,697 A	5/1996	Dalla Betta et al.

(73) Assignee: **Battelle Memorial Institute**, Richland,  
WA (US)

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 637 days.

This patent is subject to a terminal dis-  
claimer.

(Continued)

*Primary Examiner*—N. Bhat

(74) *Attorney, Agent, or Firm*—Derek H. Maughan; Frank  
Rosenberg

(21) Appl. No.: **11/282,423**

(22) Filed: **Nov. 18, 2005**

(57) **ABSTRACT**

(65) **Prior Publication Data**

US 2006/0067861 A1 Mar. 30, 2006

The present invention is a chemical reactor and method for  
catalytic chemical reactions having gas phase reactants. The  
chemical reactor has reactor microchannels for flow of at least  
one reactant and at least one product, and a catalyst material  
wherein the at least one reactant contacts the catalyst material  
and reacts to form the at least one product. The improvement,  
according to the present invention is: the catalyst material is  
on a porous material having a porosity that resists bulk flow  
therethrough and permits molecular diffusion therein. The  
porous material further has a length, a width and a thickness,  
the porous material defining at least a portion of one wall of a  
bulk flow path through which the at least one reactant passes.

**Related U.S. Application Data**

(60) Continuation of application No. 10/264,792, filed on  
Oct. 4, 2002, now Pat. No. 6,984,363, which is a divi-  
sion of application No. 09/375,614, filed on Aug. 17,  
1999, now Pat. No. 6,488,838.

(51) **Int. Cl.**

**C10J 3/20** (2006.01)

**B01J 8/08** (2006.01)

(52) **U.S. Cl.** ..... **48/63**; 48/127.7; 422/190;  
422/191; 422/195; 422/217; 422/218

**7 Claims, 3 Drawing Sheets**

